

Appln. No.: 10/686,893
Amendment Dated November 30, 2005
Reply to Office Action of August 31, 2005

YAO-3990US3

Remarks/Arguments:

By this Amendment, Applicants have amended claim 8. Claims 8-11 are pending.

Claim Rejection Under §103

Claims 8-11 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Summerfelt. By this Amendment, Applicants respectfully traverse the §103(a) rejection.

Claim 8 is an independent claim to which claims 9-11 directly depend. Claim 8 is directed to a semiconductor device having a titanium material layer and a silicon oxide layer produced by a process including the following steps:

- etching at least one of the titanium material layer and the silicon oxide layer using an etchant,

- wherein:

the titanium material layer includes at least one material selected from the group consisting of BaTiO_3 , SrTiO_3 , $\text{Ba}_x\text{Sr}_{(1-x)}\text{TiO}_3$, and similar Group IIA material titanates, **the titanium material layer is provided between an upper electrode and a lower electrode, and a contact window is provided for each of the upper electrode and the lower electrode,**

the etchant includes a mixed liquid of HCl , NH_4F and H_2O , and setting a molar ratio of $\text{NH}_4\text{F}/\text{HCl}$ in the mixed liquid, the molar ratio being set based on which of the at least one of the titanium material layer and the silicon oxide layer is to be etched.

It is Applicants' position that the semiconductor device defined by Independent claim 8 is patentably distinguished from the Summerfelt patent at least based on the feature of the titanium material layer being provided between an upper electrode and a lower electrode, and a contact window being provided for each of the upper electrode and the lower electrode (hereinafter generally referred to as the "Contact Window Feature" of Applicants' claimed invention). In other words, the Summerfelt patent neither teaches nor suggests the Contact Window Feature of Applicants' claimed invention. And thereby, claim 8 and the claims dependent thereon are patentably distinguished from the Summerfelt patent.

Applicants respectfully submit that the amendment to claim 8 is not the addition of new matter but is based on the application as originally filed. In this connection, Applicants direct the Examiner to the following disclosure, for example, found between pages 8 and 10 of the originally filed application.

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As shown in Fig. 3A, a first silicon oxide layer 7a is deposited on a substrate 1, and then a lower electrode layer 2 and a high dielectric constant capacitor material layer 3 are sequentially formed on the silicon oxide layer 7a. * * * As shown in Fig. 3C, a resist mask 8 for forming holes 8a in the silicon oxide layer 7b is formed, through which interconnects will be described. * * * [A]n interconnect material layer 9 is formed on the second silicon oxide layer 7b so as to fill the holes 8a. * * * The interconnect material layer 9 acts as an upper electrode layer. (See, for example, Figs. 3A-3D, and Example 3, and pg. 8, line 19 to pg. 9, line 11).

As show in Fig. 4A, a first silicon oxide layer 7a is deposited on a substrate 1, and then a lower electrode layer 2 and a high dielectric constant capacitor material layer 3 are sequentially formed on the silicon oxide layer 7a. As shown in Fig. 4B, an upper electrode layer 4 is vapor-deposited thereon and then lifted off. Then, a second silicon oxide layer 7b is deposited on the first silicon oxide layer 7a so as to cover the lower electrode layer 2, the high dielectric constant capacitor material layer 3 and the upper electrode layer 4. As shown in Fig. 4C, a resist mask 8 for etching the second silicon oxide layer 7d and the high dielectric constant capacitor material layer 3 is formed on the second silicon oxide layer 7b. (See, for example, Figs. 4A-4D, Example, 4, and pg. 9, line 22 to pg. 10, line 2).

Exposed areas of the second silicon oxide layer 7b and the areas of the high dielectric constant capacitor material layer 3 below the exposed areas of the second silicon oxide layer 7b are etched in one step as shown in Fig. 4D, using an etchant which is prepared so as to have a $\text{NH}_4\text{F}/\text{HCl}$ molar ratio of substantially one, preferably between 0.8 and 1.2. Thus, a contact window 8c for the upper electrode layer 4 and a contact window 8d for the lower electrode layer 2 are formed. (Emphasis added; see, for example, Figs. 4A-4D, and Example 4, and pg. 10, lines 4-12).

The Summerfelt patent in general relates to a method of fabricating a high-dielectric constant oxides on semiconductors. A method is described for fabricating a structure useful in semiconductor circuitry. The method includes growing a germanium layer 28 directly or indirectly on a semiconductor substrate 20, and depositing a high-dielectric constant oxide 32 on the germanium layer.

In rejecting independent claim 8, the Examiner focuses on Fig. 1 of the Summerfelt patent which is a cross-section of one embodiment of a multi-layer structure using a polycrystalline Ge buffer layer. But nowhere in the Summerfelt patent is there any teaching or suggestion that a contact window is provided for each of the upper electrode and the lower electrode as defined in Applicants' claim 8.

In Applicants' claimed invention, for example, contact windows are positively formed on an upper electrode 4 and a lower electrode 2 as shown in Fig. 4D, so that in subsequent steps (for example in a wiring step), the lower electrode 2 and the upper electrode 4 are not short-

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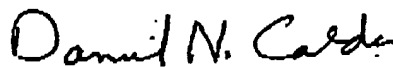
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circuited. Nowhere in the Summerfelt patent is there any disclosure, suggestion or teaching of a combination of the configuration of Applicants' claimed invention and an etching. Thus, in the Summerfelt method, the processing precision for an electrode and a capacitance layer is not improved, which thereby may result in the occurrence of a short-circuit between electrodes which bridge the capacitance layer.

Because the Summerfelt patent does not teach or suggest that a contact window is provided for each of the upper electrode and the lower electrode as set forth in independent claim 8, Applicants' contend that claim 8 and dependent claims 9-11 are patentably distinguished. Applicants therefore respectfully request that the §103(a) rejection be withdrawn.

In view of the foregoing remarks and amendments, Applicants respectfully submit that claims 8-11 are in condition for allowance. Reconsideration and allowance of all pending claims are respectfully requested.

Respectfully submitted,



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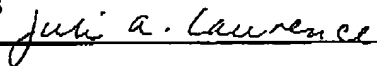
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